

1 **Prognostic models in obstetrics: available, but far from applicable**

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38 **Condensation:** Many prognostic models are developed in the field of obstetrics, but very few
39 models are validated, and their impact on clinical practice is unknown.

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41 **Short title:** Prognostic models in obstetrics.

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45

46 **Abstract**

47

48 Healthcare provision is increasingly focused on the prediction of patients' individual risk for
49 developing a particular health outcome in planning further tests and treatments. There has
50 been a steady increase in the development and publication of prognostic models for various
51 maternal and fetal outcomes in obstetrics. We undertook a systematic review to ~~assess the~~
52 ~~quality, validity and applicability of prognostic models published in the field of obstetrics.~~
53 give an overview of the current status of available prognostic models in obstetrics in the
54 context of their potential advantages and the process of developing and validating models.
55 Important aspects to consider when assessing a prognostic model are discussed and
56 recommendations on how to proceed on this within the obstetric domain are given.

57 We searched MEDLINE (up to July 2012) for articles developing prognostic models in
58 obstetrics. We identified 177 papers that reported the development of 263 prognostic
59 models for 40 different outcomes. The most frequently predicted outcomes were pre-
60 eclampsia (n=69), preterm delivery (n=63), mode of delivery (n=22), gestational
61 hypertension (n=11) and small for gestational age infants (n=10). The performance of newer
62 models was generally not better than that of older models predicting the same outcome.
63 The most important measures of predictive accuracy (i.e. a model's discrimination and
64 calibration) were often (82.9%, 218/263) not both assessed. Very few developed models
65 were validated in data other than the development data (8.7%, 23/263). Only two thirds of
66 the papers (62.4%, 164/263) presented the model such that validation in other populations
67 was possible, and the clinical applicability was discussed in only 11.0% (29/263). The impact
68 of developed models on clinical practice was unknown.

69

70 We identified a large number of prognostic models in obstetrics, but there is relatively little
71 evidence about their performance, impact and usefulness in clinical practice so that at this
72 point, clinical implementation cannot be recommended. New efforts should be directed
73 towards evaluating the performance and impact of the existing models.

74

75 **Keywords:** prediction, obstetrics, pregnancy, model

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77 Medicine, including obstetrics, is increasingly focused on risk-based or personalized
78 medicine: treatment or preventive interventions as well as elaborate or burdening
79 prognostic tests are administered based on a patients' risk for developing ~~(prognosis)~~-a
80 certain health outcome (prognosis).¹ Identification of patients at high risk can be based on a
81 single risk factor, risk indicator or predictor (e.g. a particular patient characteristic,
82 biomarker or test result) or on a combination of multiple predictors. The prevailing thought
83 is that combining predictors into a so-called risk prognostic or decision model allows for
84 better risk assessment and patient selection than single predictors, tests or markers.²

85 Two historical examples of prognostic models in obstetrics are the Apgar score to
86 assess the condition of a newborn baby immediately after birth, and the Bishop score to
87 assess cervical ripeness before and during induction of labour.^{3,4} Both models were
88 developed in the 1950-60's, before the introduction of the currently recommended methods
89 for prognostic research, but ~~and~~ are still widely used in clinical practice, presumably because
90 of their relevance and ease of use. Over the years, many prognostic models have been
91 developed and published.¹ The authors of this opinion paper have signaled a rise in the
92 number of prognostic models being published, including for obstetric outcomes, without the
93 corresponding increase in the number of models being applied in practice. The aim of this
94 paper is to give a comprehensive overview of the current status of available prognostic
95 models in obstetrics in the context of the potential advantages of prognostic models, the
96 advocated process of developing and validating models, important aspects to consider when
97 assessing a prognostic model, and how we should proceed on this within the obstetric
98 domain.

99

100 **Why use prognostic models?**

101 The ultimate goal of risk-based management is to allow for timely diagnosis and prognosis
102 and consequently more effective management. Based on patients' risks, interventions can
103 be applied to those that potentially benefit most, thereby improving patient outcomes while
104 saving costs and avoiding unnecessary burden by refraining from treatment for individuals
105 unlikely to benefit from a certain intervention. Here, prognostic models can aid in several
106 ways. They may serve as an alert (e.g., when a woman or newborn needs immediate medical
107 care), be used for individual decision making (e.g., to choose an alternative treatment or
108 refrain from treatment when the chances of success or improvement are low), aid in
109 organizational planning (e.g. availability of staff and the operating theatre when the risk of
110 an operative delivery is high), or allow for individualized counseling of patients (e.g. in the
111 decision of a pregnant woman to opt for external cephalic version).⁵⁻⁸ We will first describe
112 the currently available models in obstetrics for potential use.

113

114 **Available prognostic models in obstetrics**

115 As there was no overview of prognostic models available for potential use, we undertook a
116 systematic review of the literature on this topic ~~according~~[adhering to the principles in to the](#)
117 ~~PRISMA guidelines~~[PRISMA Statement](#).

118 We searched MEDLINE through PubMed on July 1st, 2012 without language or publication
119 date restrictions to identify papers reporting on the development of a prognostic model in
120 obstetrics. The search strategy was based on terms related to women, pregnancy and
121 obstetrical topics combined with sensitive and specific methodological filters,⁹ allowing
122 efficient identification of publications on prognostic models (Appendix 1). We defined a
123 prognostic model as a model that could be used to estimate risks for individual patients, or
124 to distinguish groups of patients at different risks, based on three or more predictor

variables. Papers were excluded if the described model was to be used for diagnosis of a current condition rather than for predicting a future outcome, or the predicted outcome was outside the field of obstetrics, defined as an outcome concerning the pregnant, laboring or post-partum woman immediately after delivery, or the fetus (for example: fetal growth restriction), or the neonate immediately after birth (for example, birthweight). Eligible papers were selected by two reviewers (EK and ES). Titles and abstracts of all papers identified by the search were scrutinized for eligibility. After 300 abstracts were screened in duplicate, which showed good agreement between both reviewers (kappa-statistic=0.71, indicating that 98.7% of papers was scored the same by both reviewers), the remaining were assessed by one reviewer. In case of doubt about eligibility, the paper was discussed with the other reviewer to accomplish a joint decision. Once selected, both reviewers examined the full text papers to see whether they met the inclusion criteria. Disagreements about inclusion at any stage of the selection process were resolved by consensus.

From 10 152 citations, a total of 177 papers met inclusion criteria and described the development of one or more obstetric prognostic models (Figure 1).¹⁰⁻¹⁸⁶ Overall, we identified 263 models for 40 different outcomes. The oldest paper identified was published in 1976. Since then, the number of available papers and prognostic models increased markedly (Figure 2). These findings are consistent with those reported elsewhere for other clinical areas.¹⁸⁷ The marked increase in the number of available obstetrical prognostic models indicates that clinicians and researchers are increasingly interested in 'risk-based medicine' or 'personalized medicine' (Figure 3).

Of the 40 different outcomes that were predicted, there were 15 outcomes for which only one model was developed, 14 outcomes for which two or three models were identified, six outcomes for which between four and ten models were available, and five outcomes with

ten or more published models. The five most frequently predicted outcomes were pre-eclampsia (n=69), preterm delivery (n=63), mode of delivery (n=22), gestational hypertension (n=11) and small for gestational age neonates (n=10). Among these five outcomes, many more models were developed for predicting pre-eclampsia and preterm delivery than for any other outcome. Both pre-eclampsia and preterm delivery are highly prevalent conditions in obstetrics (up to, and just over, an incidence of 10%, respectively) and are major causes of adverse outcomes.¹⁸⁸⁻¹⁹⁰ The prevalence and clinical importance of these conditions and the potential benefits of early (preventive) treatment (aspirin for prevention of pre-eclampsia and progestagens, pessary or cerclage for prevention of preterm delivery) and organization of care (antenatal corticosteroids, intra-uterine transfer to centers with neonatal intensive care facilities) may explain the large number of models developed for these outcomes.

161

162 **Important aspects to consider when appraising models**

Box 1 describes some of the important concepts in prognostic model studies. Papers describing a prognostic model should report these items that allow for assessment of model performance and applicability, as well as describe a clear definition of the predictors and outcome, details of the population studied, study design (e.g. cohort or case control), sample size and statistical methods including selection of predictors and handling of missing data.¹⁹¹⁻

¹⁹³ Each model included in the systematic review was thoroughly assessed for methodological development and validation as well as reporting, with the use of a checklist including these items. Appendix 2 gives an overview of all included models and details of their performance, validity and applicability.

Whether the identified models in obstetrics reported model performance (calibration and discrimination), presented the model such that it could be used by others, gave guidance for clinical use and whether they were internally or externally validated (or both) is [also](#) shown in Table 1. Of the 263 identified models, 57 models (21.7%) were internally validated and only 23 (8.7%) were externally validated (Figure 2). Details of model performance, either apparent or at internal or external validation, included calibration of only 46 models (17.5%), details of discrimination for 165 models (62.7%) and both calibration and discrimination were presented for 45 models (17.1%). A prognostic formula, rule or score that could be used by others was reported for 164 models (62.4%) and guidance for clinical use was discussed for 29 (11.0%).

For predicting pre-eclampsia and preterm delivery many models have been developed, but only 7.2% (5/69) and 6.3% (4/63), respectively, have been externally validated. Overall, model performance was lower at external validation than at apparent or internal validation. High discrimination (area under the receiver operating characteristic curve (AUC) >0.90) either at apparent or internal validation was observed in the development phase of 25% and 24% of models for which discrimination was presented, respectively. For preterm delivery, AUCs of models at external validation ranged between 0.65 and 0.72. For pre-eclampsia, AUCs were between 0.70 and 0.85 (all models for late pre-eclampsia). For both outcomes we found that recently developed models did not have better performance than already existing models ([see also Appendix 2](#)).

Why are existing models not yet applicable and not being used?

Despite the availability of many models for various outcomes, we are not aware of any (recent) obstetrical models that have found their way into routine practice. The reasons for

196 this may be multiple: (1) clinicians may be in doubt on whether to rely on probabilities pro-
197 vided by these models (i.e. face validity),⁶ because models may not include well-known
198 predictors of the outcome. Additionally, in obstetrics there tends to be an inverse relation
199 between outcomes of mother and baby, e.g. early delivery to benefit the mother might
200 compromise baby's outcome due to prematurity, so combining models developed on
201 different datasets for maternal and perinatal outcomes may lower face validity. Another
202 related issue, sometimes described as treatment paradox, can corrupt face validity when
203 models are appropriately developed within the same dataset. Predictors of the outcome or
204 interventions that may benefit the mother but at the same time compromise the baby's
205 health or vice versa, leave the clinician in doubt on whether to rely on probabilities provided
206 by these models. (2) Individuals often rely on simple heuristics, i.e. cognitive processes,
207 conscious or unconscious, that ignore part of the information, which hampers incorporation of
208 prognostic models into clinical practice.¹⁹⁴ (3) ~~P~~rognostic models are often too complex for
209 daily use in clinical settings without computer support (although the introduction of
210 computerized patient records will clearly facilitate their application in routine care).¹⁹⁵ (4)
211 ~~P~~reventive treatment for the outcome that is predicted may not exist~~s~~, so clinicians may
212 prefer expectant management ~~instead of using a model~~ and treat the patient when the
213 disease eventually develops ~~instead of using a model~~. (5) ~~M~~any prognostic models have
214 not been validated in other populations, meaning that their generalizability is unclear,¹⁹⁶ and
215 (6) the reporting and methodological quality may be questionable or unclear.^{191;192;197-199}
216 despite (recommended) methods for development of prognostic models that are well-
217 described and available in commonly used statistical software.^{1;200}

218 There are several steps to be taken between the development of a prognostic model
219 and its use in practice.⁶ Firstly, one should question whether the implementation of a

220 prognostic model with acceptable performance is likely to improve patient care, decision
221 making, patient outcomes, counseling or organization of care. Most authors of the papers
222 identified by our systematic review described in their introduction that the possibility of
223 accurate risk estimation for a variety of conditions would potentially have huge advantages.
224 However, in the discussion it was usually not described how the prognostic model should be
225 used or what was defined as being low or high risk. Secondly, a prognostic model should be
226 developed using a sound methodological approach and its performance combined with ease
227 of application should indicate whether the models warrants further investigation and
228 validation. Interestingly, while reading the full-text papers, we observed that many reported
229 that the addition of biomarkers (such as cervical length, fetal fibronectin, serum protein
230 levels) to characteristics of maternal and obstetric history (age, parity, previous conditions)
231 and routine examinations (body mass index, blood pressure) often improved model
232 discrimination up to an acceptable performance. However, if acceptable performance can be
233 achieved with the use of only 'readily available' variables this could make a model easier
234 (and therefore perhaps more likely) to be used in practice. Thirdly, new or existing models
235 should be externally validated, ideally by independent investigators, and compared to
236 competing models,²⁰¹ and, if necessary, updated. Less than 10% of the identified models in
237 obstetrics have been externally validated, either in the same paper or by an independent
238 research group.¹⁹⁸ Additionally, only 164 models (62.4%) were ~~in~~-presented in a manner for
239 others to use, meaning that either external validation or clinical use would ~~not~~-be possible. A
240 fourth step after validation is to investigate whether using the prognostic model actually
241 improves patient care: whether patient outcomes are better when changes in clinical
242 management are made based on, or are supported by, the prognostic information provided
243 by the model. This can be studied, for example, in a randomized trial that compares one or

244 | more treatment strategies guided by the prognostic model with care as usual (without the
245 | model) for relevant patient outcomes. Only one paper in our review discussed the issue of
246 | conducting a randomized trial to evaluate the potential clinical benefits of use of the
247 | model.³⁹ For all others models, impact studies – or evidence of their initiation – were lacking.
248 | In ~~this-the~~ phase of assessing model impact it should be clear how the model should be used
249 | in practice and ideally there should be a recommendation for management of women at
250 | risks higher and lower than a certain threshold. Only a tenth of the models in this review
251 | discussed guidance for future use.

252

253 | **Comment**

254 | The increasing number of prognostic models for the same outcome along with the dearth of
255 | (independent) external validation studies and, more importantly, studies evaluating the
256 | clinical impact of using the prognostic model, seems to indicate that researchers in the field
257 | of obstetrics fail to appreciate the steps required in the introduction of a new prognostic
258 | model.^{196;202} In addition, the realization that almost 40% of papers failed to present their
259 | model in a format that could be used by others (e.g. for external validation) could indicate
260 | that developers of prognostic models might not be aware of the necessity of (multiple)
261 | external validation. Furthermore, researchers seem not to critically question the
262 | consequences of developing another model along existing models for the same outcome. It
263 | has even been suggested that the increase in prognostic models can be partly attributed to
264 | the simplicity of publishing yet another paper, simply for sake of publication rather than its
265 | potential use in clinical practice.²⁰³ We suggest that before efforts to develop a new model
266 | are undertaken, systematic reviews should be carried out to identify and validate existing
267 | models with careful consideration to decide whether to develop a new model or update an

existing model.²⁰⁰ Afterwards, the most valid, best performing models should be studied in clinical practice in so-called impact studies to investigate its influence on patient outcomes.

The usefulness of any prognostic model is predicated on full and transparent reporting of how the model was developed and validated. If key details are not reported, including the actual prognostic model (for which our review finds that 38% were insufficiently reported), then deciding whether a prognostic model has potential for practice is difficult.¹⁹³ Systematic reviews of prognostic models in other areas of medicine have described inappropriate methodology and reporting, similar to our findings.^{187,191;192;197;199}

Consensus-based guidelines have recently been published to assist authors, readers, reviewers and journal editors on issues to report when developing or validating a prognostic model.²⁰⁴⁻²⁰⁶ When a model is already published, contacting the developers with a request for cooperation or additional information may help those who wish to further evaluate a model.

We have not described any assessment of the methodological conduct of the developed models and the quality of reporting of key methodological items. Although methodological quality of a model development study is – arguably - of less importance when a model shows good performance at external validation, the likelihood of developing a ~~generalisable-generalizable~~ model (which is not overfitted to the data on which the model is developed) is higher when recommended statistical methods have been used.¹

Based on the large amount of prognostic modeling papers, clinicians and researchers in obstetrics seem to be open to (the use of) prognostic models, but there should be realization that it takes far more than just developing a model before patients can benefit from it. Although most authors of the papers identified by our systematic review described that accurate risk estimation would potentially have huge advantages, it remains unclear if

292 using any of the identified models will truly impact clinical practice and contribute to
293 improvement of patient care. Thus, at this point, we cannot recommend the routine use of
294 any of the models. Given the potential benefits for timely prognostication and effective
295 management, it seems unfortunate that there is such a low number of applied models. The
296 Framingham risk score for future occurrence of cardiovascular disease, on which the
297 decision to start preventive interventions is based, is an example of a well-studied and
298 widely implemented prognostic model.²⁰⁷ Consequently, further investigation of model
299 validity and impact is important and should be undertaken.

300 In conclusion, in obstetrics many prognostic models are developed but there is
301 relatively little evidence about their performance, impact and usefulness in clinical practice.
302 New efforts in this context – or outside obstetrics – should be directed towards evaluating
303 the performance and impact of these existing models rather than developing new ones.

304

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Box 1: Explanation of important concepts in prognostic model development and evaluation

Concept	Description
Discrimination	<p>How well a model discriminates between patients with and without the outcome, commonly presented as the area under the receiver operating characteristics curve (AUC) or the concordance index (c-index). Both the AUC and the c-index provide the probability that the model will give a higher probability of the outcome to a patients with the outcome than a randomly chosen patients without the outcome, or that the patients with the higher probability will have the outcome sooner.</p>
Calibration	<p>The agreement between observed outcomes and predictions. For example, in a group of patients all with a predicted probability of the outcome of 20%, the incidence of the outcome should be 20%.</p> <p><u>When calibration of a model is assessed in a different population (see 'external validity'), often the predicted probabilities are too extreme (usually too high). This can be corrected by 'shrinkage' of the model coefficients with a shrinkage factor that results in better overall predictions and calibration.</u></p>
Internal validity	<p>The process of determining internal validity, or "reproducibility" of the prognostic model for the underlying population, the setting where the development data originated from.</p> <p>Techniques include apparent validation (model performance is directly assessed in the development data), split-sample validation or cross-validation (the sample is randomly divided, part of the data is used to develop the model and the part that was not used for development is used to evaluate performance) and bootstrapping (bootstrap samples are drawn with replacement from the original study sample, reflecting the drawing of study samples from the underlying population. Each sample is used to develop and evaluate the model; the difference in performance of the model between the bootstrap sample and the original sample indicates the 'optimism' of the model that arises since model parameters are optimized for the sample).</p>
External validity	<p>The process of determining external validity, or "generalizability" of the prognostic model</p>

	<p>for populations that are similar to, or related to, the development sample population.</p> <p>External validation can be performed by the same investigators who developed the model, for example in patients more recently attending for care (temporal) or in another hospital or centre (geographical) but is preferably done by other, fully independent investigators.</p>
<p>Presentation of prognostic model</p>	<p>The format in which the prognostic model is presented so that it can be used to calculate risks for individual patients or groups of patients. For a logistic regression model the intercept and regression coefficients should be reported, and for a Cox model the baseline survival and regression coefficients. In addition to presenting the full regression formula, other supplementary formats include a nomogram (a graphical presentation of the model with lines for scoring points for each predictor and a line to obtain risk from the sum of points), a score chart, and a table with predictions for certain groups based on combinations of predictor variables.</p>

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904 Descriptions are adapted from: Steyerberg EW. Clinical Prediction Models. A practical approach to

905 development, validation and updating. New York: Springer; 2009.

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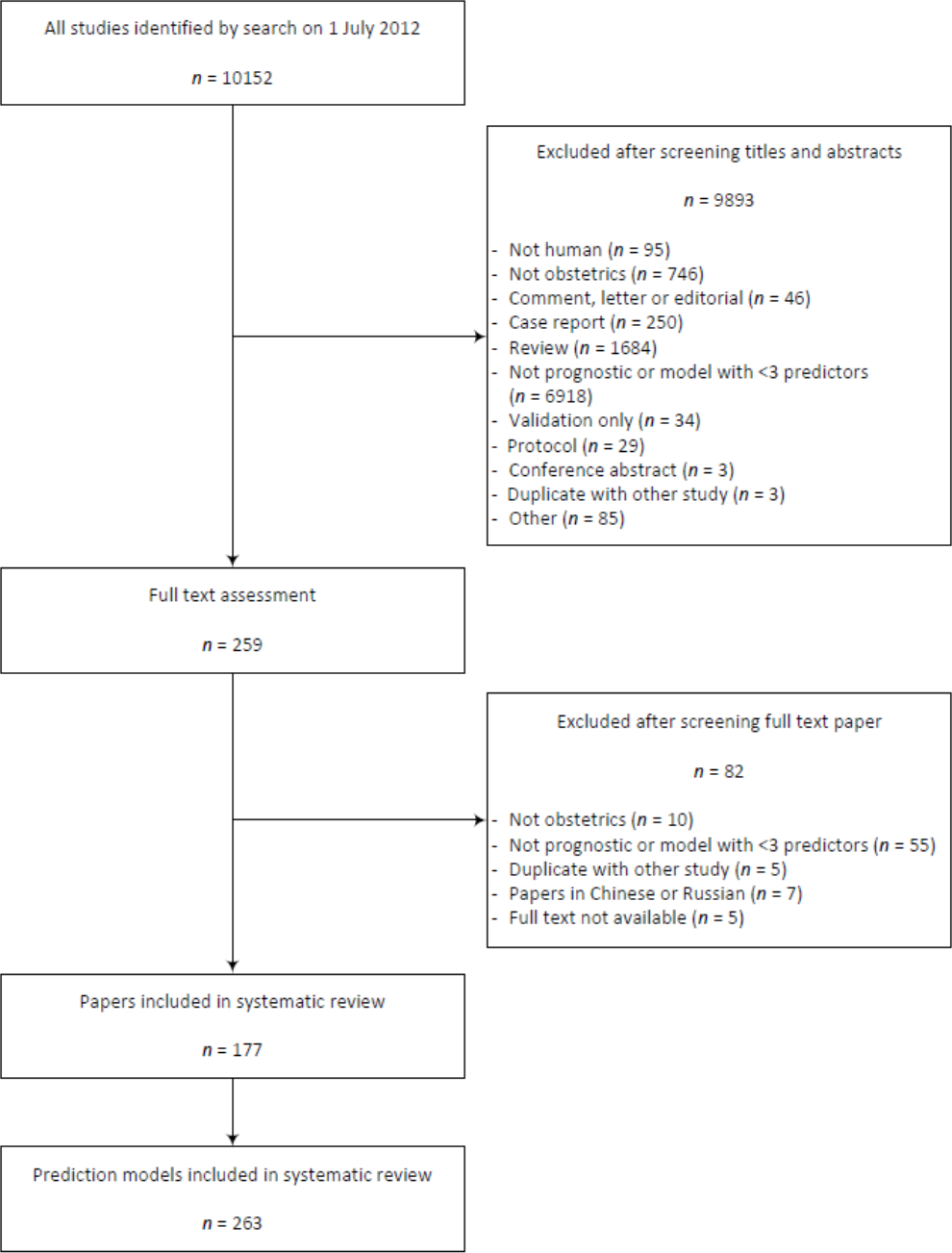
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910 **Table 1: Overview of available prognostic models**

Outcome	Number of models	Internal validation	External validation	Calibration	Discrimination	Presentation Prediction model	Decision recommended
Total	263	57 (21.7%)	23 (8.7%)	46 (17.5%)	165 (62.7%)	164 (62.4%)	29 (11.0%)
Pre-eclampsia	69	14 (20.3%)	5 (7.2%)	8 (11.6%)	60 (87.0%)	45 (65.2%)	9 (13.0%)
Eclampsia	1	1 (100%)	0	0	1 (100%)	0	0
Gestational hypertension	11	0	0	0	7 (63.6%)	9 (81.8%)	0
Preterm delivery	63	15 (23.8%)	4 (6.3%)	7 (11.1%)	34 (54.0%)	33 (52.4%)	7 (11.1%)
Gestational diabetes	9	2 (22.2%)	1 (11.1%)	1 (11.1%)	8 (88.9%)	3 (33.3%)	2 (22.2%)
Insulin treatment for gestational diabetes	1	0	0	1 (100%)	0	0	0
Abnormal glucose challenge test	1	0	1 (100%)	0	1 (100%)	1 (100%)	0
Congenital malformations	3	0	0	0	3 (100%)	0	0
Small for gestational age neonate	10	3 (30.0%)	0	2 (20.0%)	6 (60.0%)	5 (50.0%)	0
Intra-uterine growth restriction	4	2 (50.0%)	0	1 (25.0%)	1 (25.0%)	4 (100%)	1 (25.0%)
Birthweight	3	1 (33.3%)	2 (66.7%)	0	1 (33.3%)	3 (100%)	1 (33.3%)
Low birthweight	1	1 (100%)	0	1 (100%)	0	1 (100%)	0
Vaginal birth after caesarean	9	4 (44.4%)	2 (22.2%)	3 (33.3%)	4 (44.4%)	6 (66.7%)	0
Induction of labor	1	0	0	0	1 (100%)	1 (100%)	0
Successful induction of labor	8	0	0	0	2 (25.0%)	4 (50.0%)	0
Mode of delivery	22	3 (13.6%)	5 (22.7%)	10 (45.5%)	14 (63.6%)	18 (81.8%)	4 (18.2%)
Time to delivery	1	0	0	0	0	0	0
Successful external cephalic version	4	3 (75.0%)	3 (75.0%)	3 (75.0%)	1 (25.0%)	4 (100%)	3 (75.0%)
Vaginal delivery after external cephalic	1	1 (100%)	0	0	1 (100%)	1 (100%)	0

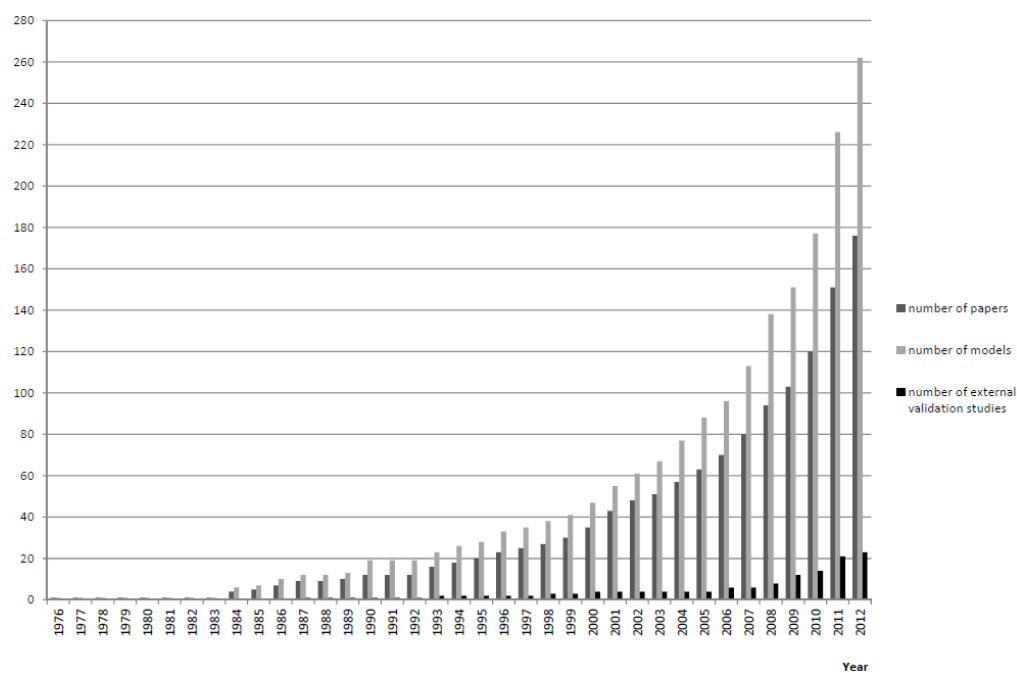
version							
Mode of delivery in breech presentation	1	0	0	0	0	0	0
Intra-amniotic infection and/or inflammation	2	0	0	2 (100%)	2 (100%)	2 (100%)	0
Clinical infection	1	1 (100%)	0	0	1 (100%)	1 (100%)	0
Histologic signs of infection	1	0	0	0	1 (100%)	0	0
Miscarriage or early fetal loss	2	0	0	0	1 (50.0%)	1 (50.0%)	0
Stillbirth	3	0	0	0	2 (66.7%)	2 (66.7%)	0
Perinatal mortality or survival	2	1 (50.0%)	0	1 (50.0%)	0	2 (100%)	0
Poor perinatal outcome	2	0	0	0	0	1 (50.0%)	0
Hypertensive disorders (combined) or placenta-related complications	3	1 (33.3%)	0	0	3 (100%)	1 (33.3%)	0
Placenta praevia	1	0	0	0	1 (100%)	0	0
Shoulder dystocia	3	1 (33.3%)	0	1 (33.3%)	2 (66.7%)	1 (33.3%)	0
Birth trauma	3	0	0	0	0	3 (100%)	0
Placental abruption	4	0	0	0	1 (25.0%)	3 (75.0%)	0
Postpartum hemorrhage	3	1 (33.3%)	0	1 (33.3%)	1 (33.3%)	2 (66.7%)	0
Anal sphincter injury	1	0	0	0	0	1 (100%)	0
Thrombosis	2	0	0	0	0	2 (100%)	2 (100%)
Maternal complications of attempted VBAC	2	0	0	0	2 (100%)	0	0
Maternal complications of pre-eclampsia	2	2 (100%)	0	2 (100%)	2 (100%)	1 (50.0%)	0
Combined adverse pregnancy outcome	1	0	0	0	0	1 (100%)	0
Short cervix	1	0	0	1 (100%)	1 (100%)	1 (100%)	0
Higher CRH levels	1	0	0	1 (100%)	0	1 (100%)	0

911 | **Figure 1:** Selection of studies for inclusion in ~~this~~the systematic review



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913 **Figure 2: Cumulative number of published papers describing prognostic models and**
 914 **number of available models and external validation studies**



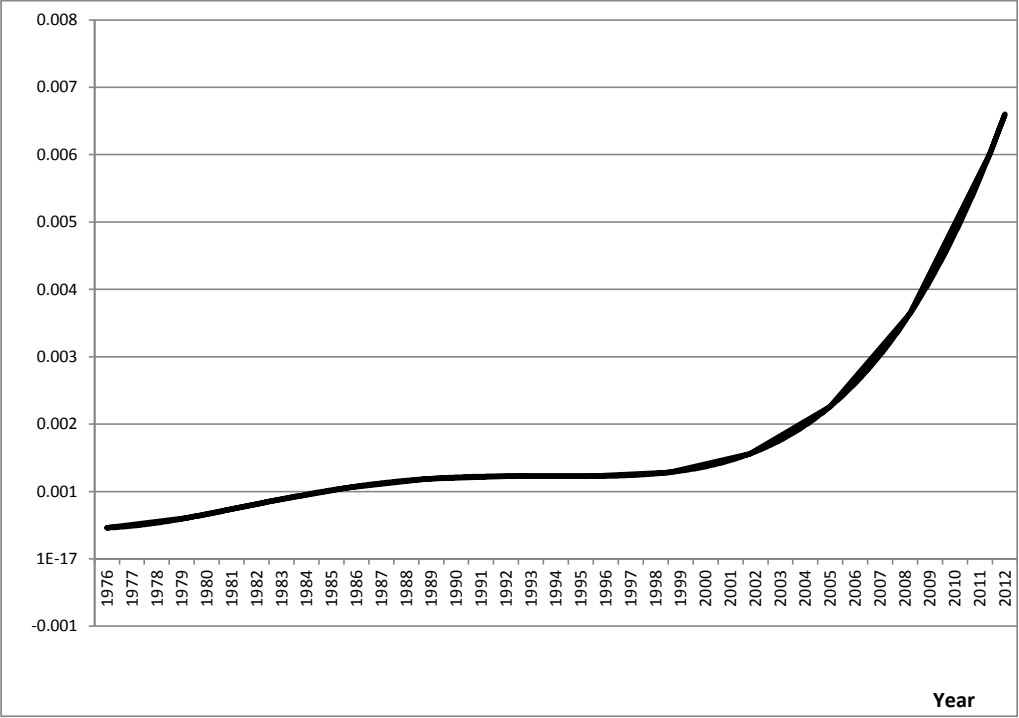
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 916 One paper (describing 2 models) was published online in 2012 and in print in 2013. With advancing period, the
 917 total number of models increased more than the total number of papers describing these models, so more
 918 papers describing more than one model were published. The number of external validation studies does not
 919 increase as markedly as the number of published prediction models.

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Figure 3: Ratio between number of published prediction models and total number of published obstetrical papers per year



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925 **Appendix 1: Search strategy for MEDLINE (through PubMed)**

- 926
- 927 1. Validat*[tiab] OR Predict*[ti] OR Rule*[tiab]
- 928 2. Predict*[tiab] AND (Outcome*[tiab] OR Risk*[tiab] OR Model*[tiab])
- 929 3. (History[tiab] OR Variable*[tiab] OR Criteria[tiab] OR Scor*[tiab] OR
- 930 Characteristic*[tiab] OR Finding*[tiab] OR Factor*[tiab]) AND (Predict*[tiab] OR
- 931 Model*[tiab] OR Decision*[tiab] OR Identif*[tiab] OR Prognos*[tiab])
- 932 4. Decision*[tiab] AND (Model*[tiab] OR Clinical*[tiab] OR Logistic Model*[tiab])
- 933 5. Prognostic[tiab] AND (History[tiab] OR Variable*[tiab] OR Criteria[tiab] OR Scor*[tiab]
- 934 OR Characteristic*[tiab] OR Finding*[tiab] OR Factor*[tiab] OR Model*[tiab])
- 935 6. "risk score"[All fields] OR "prediction model"[All fields] OR "prediction rule"[All fields]
- 936 OR "risk assessment"[All fields] OR "algorithm"[All fields]
- 937 7. # 1 OR #2 OR #3 OR #4 OR #5 OR #6
- 938
- 939 8. pregnan*[tiab] OR obstetric*[tiab] OR woman[tiab] OR women[tiab]
- 940 VBAC[tiab] OR anal sphincter rupture[tiab] OR post partum haemorrhage[tiab] OR
- 941 vacuum extraction[tiab] OR forceps extraction [tiab] OR caesarean [tiab] OR casarean
- 942 [tiab] OR caesarian [tiab] OR cesarian [tiab] OR shoulder dystocia[tiab] OR manual
- 943 placenta removal[tiab] OR gestational diabetes[tiab] OR placenta praevia[tiab] OR
- 944 abruption [tiab] OR cervical incompetence[tiab] OR cervical length [tiab] OR growth
- 945 restrict* OR external cephalic version[tiab] OR breech OR rupture of
- 946 membranes[tiab] OR PROM[tiab] OR PPRM [tiab] OR preeclampsia[tiab] OR pre-
- 947 eclampsia [tiab] OR pregnancy induced hypertension[tiab] OR HELLP[tiab] OR vaginal
- 948 deliver* [tiab] OR preterm deliver* [tiab] OR preterm labour [tiab] OR preterm labor
- 949 [tiab] OR preterm birth [tiab]
- 950 9. #7 AND #8
- 951
- 952 #9 NOT (Animals[MeSH] NOT Humans[MeSH])